Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

white, frequently tinged with rufous and with a broad subterminal band of black, outer frequently white, tinged with ashy and barred with black. Bill light blue, legs yellow. Back generally with transverse stripes of black, but frequently with very few or entirely without; rufous spot on the head, variable in size, and sometimes wanting.

Younger male: Upper parts as above; wing coverts and tail ferrugineous red, with numerous transverse bands of brownish black. Under parts with numerous longitudinal stripes, and on the sides with transverse bands of brownish black, external feathers of the tail palest, broad subterminal band on the tail obscure or wanting.

Young: All the rufous parts of the plumage with wider transverse bands of brownish black; wing coverts dark bluish cinereous, with large circular spots of black; under parts with longitudinal stripes, and large circular spots of black."

NATURE'S MEANS OF LIMITING THE NUMBERS OF INSECTS.

BY A. S. PACKARD, JR.

A FEW hints regarding the natural enemies of our injurious insects are here thrown together in order to call the attention of our naturalists and agriculturists to the subject, and provoke inquiries during the coming summer. There is no more interesting subject to our entomologists and ornithologists, than the relations between birds and insects, while the subject of rearing by the wholesale ichneumon and Tachina flies is of vital importance to agriculture.

In the first place I desire to correct a false impression I may have conveyed in my last entomological report to the Massachusetts Board of Agriculture regarding the relation of birds to the canker worm. I there remark that "it would seem as if the birds did not feed upon it to much extent." Wishing to examine into the matter more closely, I have in lack of observations of my own, availed myself of the knowledge of some of our ornithologists.

I am indebted to Mr. C. J. Maynard of Ipswich for the following information upon the birds which devour the canker worm. He informs me that in the course of his investigations he has opened the stomachs of some three thousand birds.

"In answer to your questions relative to birds eating canker worms and the larvæ of other injurious insects I would say that upon examining my notes, I find that I have taken canker worms from the stomachs of the following species:—red-eyed vireo (*Vireo olivaceus*), song sparrow (*Melospiza melodia*), chickadee (*Parus atricapillus*), scarlet tanager (*Pyranga rubra*), robin (*Turdus migratorius*), black billed cuckoo (*Coccygus erythrophthalmus*), wood pewee (*Contopus vireus*), least pewee (*Empidonax minimus*), Wilson's thrush (*Turdus fuscescens*), black and white creepers (*Mniotilta varia*), blue yellow-backed warbler (*Parula Americana*), Maryland yellow-throat (*Geothlypis trichas*), Nashville warbler (*Helminthophaga ruficapilla*), golden-crowned thrush (*Seiurus aurocapillus*), chestnut-sided warbler (*Dendroica Pensylvanica*), yellow warbler (*D. æstiva*), black and yellow warbler (*D. maculosa*), prairie warbler (*D. discolor*), black-polled warbler (*D. striata*), Canada warbler (*Myiodioctes Canadensis*), redstart (*Setophaga ruticilla*), cedar bird (*Ampelis cedrorum*), cat bird (*Mimus Carolinensis*), purple finch (*Carpodacus purpureus*), white winged crossbill (*Curvirostra leucoptera*), chipping sparrow (*Spizella socialis*), indigo bird (*Cyanospiza cyanea*), red-winged blackbird (*Agelaius phœniceus*), cow blackbird (*Molothrus pecoris*), bob-o-link (*Dolichonyx oryzivorus*), Baltimore oriole (*Icterus Baltimore*).

Possibly this list may be increased. Besides these birds, those species which occur in orchards during autumn and winter, such as the ruby-crowned wren, brown creeper, nuthatches and titmice, doubtless eat largely of the eggs of canker worms and other insects which destroy or injure the trees. Winter birds of the above species which I have shot at this time have their stomachs crammed with insects of some kind.

As I remarked to you the other evening the Baltimore oriole will eat largely of the tent caterpillar, and is the only bird which will do this.

All the thrushes will eat wire worms. The swallows destroy multitudes of dipterous insects (gnats, etc.). In fact to sum the matter up there is scarcely a bird which will not eat largely of insects at certain seasons, when these pests are most abundant.

It is a noticeable fact that many species inhabiting woods and meadows, as may be seen by the list given, leave their usual haunts and visit the fruit trees which are covered with canker worms and largely devour them.

In reference to the currant saw fly worm (*Nematus ventricosus*) I am not certain that I have seen any birds eat them, yet I think the truly insectivorous species will do this."

That the Baltimore oriole sometimes eats large quantities of the American tent caterpillar (*Clisiocampa Americana*), since they have been found in the stomach of this bird by Mr. Maynard, is an interesting fact, for birds as a rule do not relish hairy caterpillars, and the American tent caterpillar is covered with long hairs, though they are not so dense as in some other larvæ. In Europe the closely allied tent caterpillar (*C. neustria*), and those of the *Cnethocampa* and *Liparis chrysorrhœa* are said by Perris and others to be almost untouched by birds. I have been told by Dr. T. M. Brewer of Boston that the English sparrows upon the common devoured all the caterpillars of the tussock moth (*Orgyia*) which were injuring a fine tree. These caterpillars are very hairy, being adorned with pencils and tufts of long hairs.

Mr. John H. Sears, of Danvers, Mass., who has paid much attention to the habits of our birds, informs me that the cuckoo, which breeds near houses, is an exceedingly useful bird, as it devours the canker worms in large numbers. It is well that this should be known, as there is a popular prejudice against this bird, from its habit of sucking the eggs, as well as laying its eggs in the nests, of other birds. Among the birds which he has himself observed in the act of eating canker worms, are the king bird, the Baltimore oriole, the cat bird, the common flycatcher, the least flycatcher or wood pewee, the red eyed vireo and a few other small birds, such as certain warblers and flycatchers. The king bird in the month of May feeds on May beetles, as stated by Mr. J. L. Hersey, in this journal.

I also quote from a letter on the subject, for which I am indebted to Dr. T. M. Brewer:—

"The most noticeable of all the destroyers of the canker worm is the common cedar bird, which devours them to an extent perfectly enormous. Next is the purple grakle which also feeds on them as long as they last. The house pigeon, if in any numbers, is an invaluable bird. See, for instance, a garden corner of Summer and Chestnut streets, Salem, where the pigeons make canker worms a thing unknown. Among the other birds, all excellent so far as they go, are the chipping sparrow, the song sparrow, the purple finch, all the vireos, white-eyed, red-eyed, yellow-throated, solitary and warbling, the king bird, the cat bird, the downy woodpecker the summer yellow bird, Maryland yellow throat, the blue-bird. The bluejay eat their eggs in the winter, so does the chickadee. The latter eats their grub also and the worm too. The common gray creeper, which is with us only in the winter, eats the eggs.

Last summer I had a nest of golden-winged woodpeckers breeding on my place at Hingham. Some of them dug into my barn and passed the winter. Only a part of my trees were protected by a belt of printers' ink and some of them were partially eaten, but this winter very few grubs have as yet shown themselves, and I give my friend *Colaptes auratus* the credit of all this. I know this—I gave the young ones a lot of the worms myself and they eat them as if they were used to them. The old birds were too shy to permit me to see by their good deeds.

I think the golden robin feeds its young with them so long as they last, but I am not sure that they eat the tent caterpillar. I nearly forgot the two cuckoos, yellow-bill and black-bill. They eat every form of caterpillar, canker worms included. I do not think the robin feeds any to its young, because it would never do; they are too small and its brood want a big lot. I have known the robin to feed its young for entire days, as fast as they could bring them, with the moth of the cut-worm. That is about as much as we could expect of any bird to do at one time. At the rate they went, they must have caught and given their young ones about five hundred of these moths in a day. Before that, I had supposed the robin did me more harm than good, but I had to give in. My indebtedness to that pair was worth all the cherries I could raise in many years. So the robin and I are fast friends."

From the facts already presented, it may be inferred how useful birds may become in the work of reducing the number of injurious insects. Undoubtedly we have suffered greatly by our wanton killing of the smaller birds. We are far behind European nations in caring for the insect-eating birds, and providing nests for them about our houses and gardens. The Swiss and French, have been the most far-sighted in this matter of the protection of the smaller insectivorous species. The English, Scandinavians and Germans foster them, while in our country, teeming as it is with hosts of ravaging insects, the smaller birds are hunted and persecuted, or if let alone, there is no effort made on any extended scale to invite them to our houses and gardens.

In this connection I may refer to the barbarous and thoughtless custom of our young men, in the autumn, organizing in companies and shooting small quadrupeds and birds. These hunting parties destroy large numbers of raccoons, foxes, skunks, mink, weasels and squirrels. It is well known that the skunk, if not an entirely inoffensive animal, is exceedingly useful. Its food consists mainly of insects, and those among the most injurious, such as the May beetle or dorbug. Mink and weasels eat insects, and squirrels as I am told, besides eating nuts, will in times of hunger eat the chrysalides of insects. It is known that all the smaller quadrupeds, even the fox, will eat insects when other food is wanting.

It is said that little harm results from shooting birds in autumn, as the breeding season is over, and the birds are migrating southward, but in the southern states they will prove as useful to agriculture there during their long winter residence, and it is a selfish policy that would injure the prosperity of farmers in one section of the country, merely to afford a day's barbarous pleasure to the inhabitants of another. Those birds which are shot in considerable numbers at such times, as partridges and quail, are insectivorous as well as vegetarians, and of late years the quail has been known to render essential service in consuming the Colorado potato beetle.

In fact this indiscriminate slaughter of small quadrupeds and birds tends to destroy the balance of nature. That there is a law of equilibrium in the distribution of the numbers of animals may be seen on a moment's examination of well known facts. The codfish is known to lay several hundreds of thousands of eggs, and yet such is the destruction of life, that few of the eggs are left untouched by other animals; and of the young that hatch, it may be safely said that only a pair of adult fish remain. Only two eggs of the original hundreds of thousands result in accomplishing the end for which so many were laid. So among the insects. The queen bee is known sometimes to lay during her whole life more than a million eggs; during the height of the breeding season, under the most favorable circumstances, laying from two thousand to three thousand eggs, and yet how slight is the increase in the numbers of the honey bee. It would be an interesting study to trace out the causes that cut short the lives of so many bees. Then look at the aphides or plant lice, with their anomalous virgin-reproduction, by which the young are produced like the buds on a tree. One virgin plant louse was found by Bonnet to bring forth on an average about one hundred young, and so on for ten generations: now add up the number of young produced by those of, say, ten broods, and we have the enormous number of 1,000,000,000,000, or a quintillion young—all descendants of one spinster plant louse. Says Professor Huxley in commenting on this fact, "I will assume that an aphis weighs $\frac{1}{1000}$ of a grain, which is under the mark. A quintillion will on this estimate weigh a quadrillion of grains. He is a very stout man who weighs 2,000,000 grains; consequently the tenth brood alone, if all the members survive the perils to which they are exposed, contains more substance than 500,000,000 stout men, to say the least, more than the whole population of China."

When we realize that so far from a quintillion, only a pair or two of plant lice survive, and at the end of the season die, after laying a few eggs, by which the species is represented in winter, we can form some idea of the struggle for existence among animals, and of the vicissitudes to which they are exposed. We can see how delicate is the balance of circumstances by which nature preserves the equilibrium, seeking, as it were, on the one hand to prevent the extinction of the species, and on the other its undue multiplication.

Now birds are an important agency in restraining the increase of species injurious to man. Yet this aid is blind and impartial. They devour useful as well as injurious insects. They sometimes eat our fruits, even if they overbalance the mischief by a strict adherence to insect diet out of the short fruit season. It follows that we must depend more upon an intimate knowledge of the habits of the birds themselves.

M. Perris in an admirable paper in the "*Mémoires de la Société Royale des Science de Liége*" (tome iii, 1873) entitled "*Les Oiseaux et les Insectes*" says:

"Almost all birds, probably even the whole of them, eat insects. Even the birds of prey, when they are an hungered, accept this makeshift, as do also, according to M. Florent Prèvost, the wolf, the fox and the badger, when they have not been fortunate in the chase. There are some birds, such as the swallows, the martins, the goatsuckers, which live exclusively on insects; others, as the nightingale, the warblers and all the birds with small beaks, which habitually consume insects, and only change their habits at the latter end of autumn, then eating berries, figs, etc.; others such as the chaffinch, the goldfinch, the sparrow, which in rearing their young prefer insects to grain, and which for the rest of the time, prefer grain to insects. Still others, for example the magpie, are omnivorous: insects, worms, larvæ, grains, fruits, small birds, small chickens, all are welcome. Finally, not to prolong this enumeration, for we should never finish if we mentioned all, the rapacious birds, such as the screech owl, the buzzard, the kite, more accustomed to live on flesh, are sometimes forced to content themselves with a morsel less succulent and less appropriate to their taste. From this very succinct and very incomplete résumé of the manner in which birds live, but which every one can extend and complete, it follows from the great number of birds that there is daily an immense destruction of insects. It is not by thousands only, but by hundreds of thousands, by millions, according to the area embraced, that we should count in fine weather and from one sunny day to another, the number of victims. The imagination shrinks at the idea of the total to which we should reach at the end of a year."

Mr. Perris then says, the main question is, How many of the insects thus eaten are injurious? We will quote our author's conclusions; though we think that in desiring to show that the protection and culture of birds are not the only way to prevent the attacks of injurious insects, as many of his countrymen think, he is a little disposed to underrate on his side their importance, which is felt in this country especially, in dealing with injurious caterpillars, such as the tent caterpillar, canker worm and the bud worm (*Penthina oculana*) of the apple and the pear, which would otherwise annihilate our apple and pear crop, as they almost threaten to do now. Remarks M. Perris:—

1. "Birds are only united in troops more or less considerable at the times of migration of autumn and spring, that is to say when most insects are infinitely less numerous than during the summer. The rest of the time, they live ordinarily in couples apart by themselves, quite rare in cultivated grounds, while the insects invade *en masse* the trees they wish to attack, the crops of which they are the enemies.

2. "Birds destroy insects enormously, but these insects are in great part neutral; some are eminently useful, and the species really injurious, compared to the whole, are scarcely at all reduced in numbers, as the birds, in consuming these little creatures, do not serve particularly our interests; they even injure us, many of them devouring our fruits as well as seeds either planted in the soil, or harvested, and especially in suppressing the carnivorous or parasitic kinds which render us great service.

3. "The insects of which we have the most to complain are either large enough to defy the birds, or (and these are the most formidable) too small to draw their attention; some of them taste too badly to excite their appetite; many are nocturnal and hide by day, with that instinct of self-preservation which is as much developed in them as in the larger animals; or, living inactive, they

do not reveal themselves to the eye of the bird, which perceives more easily and follows more willingly the insects which fly or move about. Some live under earth or in homes of their own; all are endowed with a fecundity which astonishes the imagination and which, in every case, is such that man, in spite of assiduous and persevering care, cannot even in a small farm, rid himself of them, nor often even free his house of them, not even a portion of it.

4. "The grubs and caterpillars, which are more especially the authors of the damages, live almost entirely concealed under the soil, under bark, deep in the road, in the stems of plants, in fruits, in inhabited places, under silken nets, and only pay the birds a very feeble tribute. Those which are developed in the open air are generally hairy, which repels birds; certain of them are nocturnal and disappear before day; others are protected by their excessive smallness."

Perris in another place enumerates other useful animals, and his remarks will apply in the main to this country:—

"There are among the mammalia, the moles, which without doubt do some mischief in covering our fields with mole hills . . . . . but they benefit us by destroying many insects and injurious grubs which live under the surface of the soil; besides the hedgehogs, the field mice, the great-headed field mouse (campagnol), the shrew mice, the bats, which are the more useful, in that they are nocturnal."

He also enumerates certain birds, and the larger number of the reptiles, adders, the blind worm, lizards, frogs, rennets, toad and turtle. The toads are of especial value as their only diet appears to be flies and grasshoppers and other insects. These animals are extremely sedentary. Wherever they find a supply of insects there they will remain for weeks at a time, as long as the supply lasts. On Penikese island, some of the students of the Anderson School of Natural History discovered that the stomachs of the numerous toads there were filled with young grasshoppers, and that they even hopped down to the shore and fed upon the beach-fleas which live under sea-weed between tide-marks. Toads are doubtless of use in devouring canker worms, as they abound under apple trees infested by them, and probably devour large quantities when the worms descend in June to the earth in order to undergo their transformation into the chrysalid state. It would be worth while to collect them in large numbers and place them in gardens and orchards, as once deposited there, they will remain.

Before I leave this subject of the agency of birds and other vertebrate animals in maintaining this equilibrium in the numbers of injurious and beneficial insects, I would urge the importance of a carefully conducted series of observations by some of our practical ornithologists and entomologists working in conjunction. From May until October one or several specimens of our most common insectivorous birds, as well as those occasionally so, should be daily collected, the time and nature of the day noted, and a list made of the species of insects found in their stomachs, the number of specimens, with other remarks. From the data thus collected we shall be able to form an intelligent opinion as to the vexed question, how far the birds devour indiscriminately injurious and beneficial insects; and I venture to predict that it will be found that the number of ichneumon and other beneficial kinds will form such a minimum as will be quite unimportant.

By far the most important agency in nature, and one almost incalculable in its effects, is the warfare of insects upon each other. We have seen how wonderfully fertile is the plant louse, though it may not lay an egg. Now the immense powers of multiplication of individuals in this and all other insects are held in check by carnivorous insects. One-half of the insects make war upon the other half. Insects attack one another in various ways, either by the stronger directly devouring the weaker; or as parasites they still more surely and effectually perform the work of destruction.

Among the external though less known enemies belonging to the order of beetles, which Perris enumerates from his extended observations on their habits, are a large number which live under the bark of trees. I quote his accounts of them, premising that we have similar insects with like habits in this country; and though the list of scientific names seems formidable, yet there are no common names for them. I use nearly his own words, with occasional interpolations of English names.

"When one of the Scolytids injurious to pines (the *Bostrichus stenographus*) lays its eggs under the bark, the *Platysoma oblongum* introduces itself by the hole which has given entrance to the first named insect, it lays its eggs in the gallery of the Bostrichus, and from those eggs are born the carnivorous larvæ which devour those of the wood-eating beetles. Other beetles conduct themselves in the same manner in warring against other Scolyti. The larvæ or grubs of *Plegaderus discisus* destroy the young of *Crypturgus pusillus;* another wood-eating beetle, the *Aulonium sulcatum*, is the deadly enemy of *Scolytus destructor*, so formidable a foe to shade trees; *Aulonium bicolor* attacks *Bostrichus laricis; Colydium* *bicolor* preys upon the Bostrichus of the larch; *Colydium elongatum* on *Platypus cylindrus*, *Rhizophagus depressus* on *Blastophagus piniperda* and *B. minor*, *Lœmophlœus hyperbori* on *Hyperborus ficus*, *Hypophlœus pini* on *Bostrichus stenographus*, and finally *Hypophlœus linearis* on *Bostrichus bidens*. Who will not be struck by these antagonisms? Who will not admire this infallibility of instinct which causes these insects to discover the tree attacked, and perceive, among the species which the tree conceals, the victim which has been assigned to them?"

"Other beetles exhibit the same sagacity. The larvæ of several Elaterids (wire worms) and those of *Clerus mutillarius* and *formicarius* make war on those of some longicorn beetles of the oak, the elm, alder bush and the pine. The *Opilus mollis* and *domesticus* are the enemies of the borers which mine our floors and ceilings; the *Cylidrus albofasciatus* and the *Tillus unifasciatus* prey on *Synoxylon sexdentatum* and on *Xylopertha sinuata* which seek the diseased branches of the vine, and those of several trees; the *Tarsostenus univittatus* attacks the *Lyctus canaliculatus*, injuring our timber works; while the *Trogosita Mauritanica* destroys the grain moth."

We would also add among other efficient laborers in the cause of agriculture the lady birds, lace-winged flies, Syrphus flies and numerous wasps. But the true parasites, the ichneumon and Tachina flies, those which live within the bodies of vegetable-eating insects, these are the aids which beyond all other influences keep in check the noxious kinds. It may be said that each sort of caterpillar has its peculiar ichneumon parasite, and some are known to have several. Here we have an engine of destruction which man can in some measure direct. We have seen that birds eat friend and foe indiscriminately. The great practical question in applied entomology is how can man breed and disseminate these insects, and use them as most potent instruments of warfare against insect depredators. This question has been satisfactorily settled for the first time by Dr. W. LeBaron, the State Entomologist of Illinois. So important and suggestive are his remarks that I quote the whole chapter on "The transportation of useful parasitic Insects" from his able report for 1873, as it deserves the widest dissemination among thinking agriculturists.

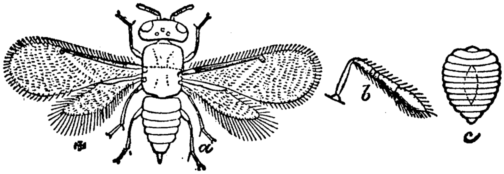
"The idea of rearing the useful parasitic insects, and of transporting them, when necessary, from one part of the country to another, has often presented itself to practical entomologists, and was a favorite topic of speculation of my predecessor in office, B. D. Walsh. But the very small size of most of these insects, many of them, indeed, being so minute that they cannot easily be seen without the aid of a lens, and the constant difficulty of manipulating them have always given a somewhat chimerical aspect to the suggestion, and have caused it to be regarded as more ingenious than practicable.

"In the course of our investigation of the oyster-shell bark louse of the apple tree, in the year 1870, we discovered a minute chalcis fly, which we designated as the chalcideous parasite of the oyster-shell bark louse, *Chalcis* (Aphelinus) *mytilaspidis*, which was found to be extensively instrumental in extirpating that deadly enemy of the apple tree, by boring into the scale and depositing her own eggs in the body, or in the midst of the eggs of the bark louse. The parasitic larvæ which hatched from this egg lived at the expense of the bark louse and its eggs, and thus caused their destruction. It was found that in several of the counties of this state where the examinations were made, that more than half of the bark lice had been destroyed by this parasite, its operations being known, partly by the presence of the little grubs beneath the scales, and partly by the minute round holes in the scales, through which the chalcis flies had escaped. It was also found, by examining the scale, late in the fall, that one brood of the chalcides hibernated in the larva state beneath the scales. The idea, therefore, readily occurred that this was a very favorable opportunity for testing the practicability of transporting these friendly parasites to those parts of the country in which their presence cannot now be detected. We had previously received several packages of apple twigs from different localities in the northern part of Illinois and the southern part of Wisconsin, heavily infested with the scales of the bark louse, but without any traces of the parasitic chalcides, and this section of country seemed therefore to furnish a favorable field in which to try the experiment of colonization.

"Captain Edward H. Beebe, of Galena, who had been passing the winter in Geneva, and who had taken a lively interest in this investigation, undertook to conduct this interesting experiment. Early in the spring of 1871, on his return to Galena, he took a package of twigs, which we had procured from trees known to have been inhabited by the chalcides, and under some of the scales upon which it was therefore probable that the larvæ were hibernating. These he tied upon trees in three different orchards, in the town of Galena, which were known to be badly infested by bark lice.

"When we consider the minute size of these insects, the fully matured fly (Fig. 72) being only one twenty-fifth of an inch in length, and that the hole in the scale of the bark louse which reveals the operation of the chalcis is so minute that it can only be seen by the aid of a magnifying glass; and we further take into account that probably less than a dozen of these larvæ were transported to the new locality, and that the small number of parasitic flies proceeding from these were let loose in three orchards containing many hundreds of apple trees, we may form some idea of the difficulties of this experiment, and of the uncertainty which would be likely to attend any observations made for the purpose of determining the presence of the chalcides. Even if the experiment should prove ultimately successful, it would be very doubtful whether the chalcis marks would be sufficiently numerous to be detected at the close of the first year, but after this they would be likely to multiply in a rapidly increasing ratio.

Fig. 72.



Aphelinus of the Apple Scale Insect.

"About the last of May, 1872, that is, after the intervention of one year from the time of commencing this experiment, Capt. Beebe examined some of the trees to which the chalcis twigs had been attached, and after a careful search thought that he had discovered a few traces of the operations of the chalcides, and sent half a dozen of the twigs bearing these marks to me for inspection. . . . . . On the 13th of July, I visited Galena and, in company with Capt. Beebe, submitted one of the trees, to which the greatest number of the twigs had been attached, to a thorough examination.

"The result, if not actually conclusive, was at least extremely encouraging. We detected a considerable number of holes in the scales, which appeared to be identical, in every respect, with those made by the chalcis in question, and in one instance we discovered three of these holes upon the same twig, within a space of four inches.

"In conducting an experiment of so delicate a nature I am well aware that the greatest caution must be exercised to avoid jumping to hasty conclusions, and that the observations of a number of succeeding years will be necessary before we can arrive at a definite conclusion that the experiment has been followed by a practical as well as scientific success.

"At the close of the author's article upon the oyster-shell bark louse, in his first annual report, after speaking of the absence of any signs of the chalcides, in the northernmost part of the state, and of the possible practicability of transporting them thither, we concluded with the following remark: 'The absence of the chalcis of the bark louse, in this locality, will furnish an excellent opportunity for testing the practicability of transporting it thither from those places where it is known to exist. If, after taking the preliminary steps, as described in a former part of this article, we should find, after the lapse of the necessary time, upon the trees experimented with, the characteristic holes in the scales which mark the exit of the chalcis, we should know that the friendly parasite had entered upon its work. If such an experiment could be conducted to a successful issue, it would furnish one of the most admirable instances on record, of the triumph of science, in its application to economic entomology.'"

In like manner the Hessian fly and wheat midge could, we believe, be kept within legitimate bounds, by the transportation from Europe of the parasites that in England and France are known to reduce their numbers materially. It would be an easy task to cause several bags of stubble containing the cocoons of these parasites to be sent over to this country, and reared here. So also the dreaded cabbage butterfly, our last European importation, can in new districts be kept under by transporting the Pteromalus or chalcis parasite, which in Essex county, Mass., is quite abundant. This rearing of ichneumon parasites can be carried on by intelligent gardeners and farmers in conjunction with an entomologist, and we look upon the future of ichneumon culture as one of the departments of a scientific, intelligent agriculture. Something should be done in the matter by the national department of agriculture, and instead of disseminating frightfully injurious insects in the seeds distributed from Washington, as is sometimes done through carelessness, it would be less harmful to scatter broadcast papers of ichneumon seed.

HABITS AND CHARACTERISTICS OF SWAINSON'S BUZZARD.

BY DR. ELLIOTT COUES, U. S. A

THIS large hawk is very abundant in northern Dakota, where it came under my observation almost daily during the summer of 1873. Excepting an occasional rough-leg or red-tail, it was the only buteonine species observed, and the only hawks more common were the ubiquitous marsh harriers and sparrow-hawks.